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Accelerometer and orbital decay measurements from Venus Express to establish properties of the Venus near polar thermosphere

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Atmospheric drag measurements from orbital decay were obtained from both Pioneer Venus (Keating, et al., 1979) and Magellan (Keating, et al., 1993) to begin to establish properties of the Venus thermosphere near the equator. Neither of these spacecraft was designed to withstand aerodynamic heating but flew safely with periapsis altitudes near 150km for years. Recently, we successfully performed thermospheric drag measurements of hundreds of vertical structures using QA 2000 accelerometers aboard Mars Odyssey (Keating et al., 2002), and we will perform similar measurements aboard Mars Reconnaissance Orbiter with the QA 2000 accelerometers in 2006. The QA 2000 accelerometers will also be flown on Venus Express; and therefore will provide a major opportunity to measure the Venusian neutral upper atmospheric structure at high latitudes to establish densities, scale heights, temperatures, and pressures. These measurements will allow us an opportunity to study many dynamical phenomena including: measurements of characteristics of the near polar thermosphere; the 100 K cryosphere in the night-side Venusian upper atmosphere; coupling between the lower and upper atmosphere including 4-day oscillations; 27- day oscillations associated with the rotating sun; and rapidly changing conditions near the day-night terminator. In order for the QA 2000 accelerometers to be sufficiently sensitive to the thermosphere, it is proposed that the Venus Express periapsis would be lowered to approximately 150km during the mission. For the Venus Express Orbit (similar to Pioneer Venus) the periapsis altitude drifts upward resulting in the periapsis having to

be dropped to lower altitudes periodically. During the Venus Express Mission, if the periapsis is initially near 250km, limited measurements could also be obtained from satellite orbital decay. At these higher altitudes “hot” species and diffusive separation of species becomes important, resulting in higher scale heights. Accelerometer measurements of atmospheric drag and measurements of orbital decay will also allow comparative planetary atmosphere studies of the thermospheres of Venus, Earth, and Mars.